CLAIMS

What is claimed is:

1. Method for measuring process parameters of a material working process using a high energy beam (2), in particular a laser beam, focused onto a working zone of a workpiece (8) by measuring with the aid of an optical sensor (10) the light intensity coaxially to the high energy radiation in the working zone in the area of vapour capillaries (14) produced by the high energy beam (2), the optical sensor (10) sensing a picture field and transmitting the measuring signals to an evaluation means (18),

   wherein an optical sensor (10) having a dynamic range of more than 70 dB is used, and

   measuring signals of sections of the image field showing the area of the vapour capillaries (14) and at least the area of the melting zone (20) surrounding the vapour capillaries (14) are simultaneously transmitted to the evaluation means (18).

2. Method according to claim 1 wherein in the picture field sensed by the optical sensor (10) different picture sections (24 to 29) are freely selectable and exclusively the measuring signals of these picture sections are used for simultaneous determination of different process parameters to be monitored.

3. Method according to claim 2 wherein the measuring signals of picture sections (27) showing the area of the melting zone (20) in front of or at the side of the vapour capillaries (14) are used for detecting defects occurring during weld preparation.

4. Method according to claim 2 wherein the measuring signals of a picture section (23) showing the melting zone (20) upstream of the working zone, as seen in the working direction, or the border area upstream of the melting zone (20) are used for measuring the weld location and for controlling the laser position or the workpiece position.

5. Method according to claim 1 wherein the penetration depth of the high energy beam (2) is determined on the basis of a reduced number of pixles of a picture section (28) showing the center of the vapour capillaries (14).

6. Method according to claim 2 wherein the measuring signals of a picture section (30) taken in the melting zone (20) downstream of the vapour capillaries (14), as seen in the working direction, and/or downstream of the melting zone (20), as seen in the working direction, are used for measuring the surface topography of the workpiece (8) to be subjected to the working process.

7. Method according to claim 2 wherein the measuring data of the different picture sections (23 to 30) are subjected to data reduction.

8. Method according to claim 1 wherein light of certain wavelengths in the beam path to the optical sensor (10) is filtered.

9. Method according to claim 1 wherein a CMOS camera is used as optical sensor (10).

10. Method according to claim 1 wherein by measuring the light intensity in the vapour capillaries (14) capillary parameters and by measuring the light intensity at at least one selected place of the melting zone (20) molten pool parameters are simultaneously determined, with control of the working process being carried out as a function of the determined capillary parameters and the determined molten pool parameters.

11. Method according to claim 1 wherein an optical sensor (10) having a dynamic range of more than 100 dB is used.

12. Method according to claim 1 wherein the focal position of the high energy beam (2) is determined by measuring the change in light intensity in a linear or rectangular picture section (29) extending through the vapour capillaries (14) and the neighboring melting zones (20).

13. Method according to claim 1 wherein the measuring signals of selected pixles are used for monitoring or process control purposes.

14. Device for measuring process parameters of a material working process comprising a means for producing a high energy beam (2), e. g. a laser beam, a focusing means (6) for focusing the high energy beam (2) onto a working zone of a workpiece (8), and an optical sensor (10) for measuring the light intensity of the vapour capillaries (14) produced in the working zone, the sensor (10) being focused coaxially to the direction of the high energy beam (2) onto the working zone of the workpiece (8), and an evaluation means (18) for evaluating the measuring signals of the scanned picture field supplied by the optical sensor (10),

wherein the optical sensor (10) has a dynamic range of more than 70 dB and transmits to the evaluation means (18) measuring signals from the area of the vapour capillaries (14) and at least an area of the melting zone (20) surrounding the vapour capillaries (14).

15. Device according to claim 14 wherein the evaluation means (18) receives only measuring signals of picture sections of the picture field covering, in addition to the area of the vapour capillaries (14), at least an area of the melting zone (20) surrounding the vapour capillaries (14).

16. Device according to claim 14 wherein the optical sensor (10) is a CMOS camera.

17. Device according to claim 14 wherein the evaluation means (18) evaluates the picture signals of a plurality of different picture sections (24 to 30) of the picture field scanned by the sensor (10) with regard to predetermined process parameters.

18. Device according to claim 14 wherein near the vapour capillaries (14) the evaluation means (18) senses, for the purpose of measuring the penetration depth of the high energy beam (2), a predetermined reduced number of pixles showing the area of the high energy beam (2).

19. Device according to claim 17 wherein the evaluation means (18) evaluates the measuring signals of picture sections (24,27) showing the area of the melting zone (20) downstream of and at the side of the vapour capillaries (14), as seen in the working direction, for the purpose of detecting defects occurring during weld preparation.

20. Device according to claim 17 wherein the evaluation means (18) evaluates the measuring signals of picture sections taken in the melting zone (20) downstream of the vapour capillaries (14), as seen in the working direction, or downstream of the melting zone (20), as seen in the working direction, for the purpose of measuring the surface topography.

21. Device according to claim 17 wherein the evaluation means (18) evaluates the measuring signals of a picture section (29) extending linearly or rectangularly through the vapour capillaries (14) and the neighboring melting zone (20) for determining the focal position of the high energy beam (2).

22. Device according to claim 14 wherein a filter (15) is arranged in the beam path to the optical sensor (10) by means of which filter (15) specific wavelengths of the light received can be blocked.